PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31	(1996) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1993) Concrete Aggregates
ASTM C 39	(1996) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 125	(1996) Terminology Relating to Concrete and Concrete Aggregates
ASTM C 150	(1997) Portland Cement
ASTM C 618	(1997) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 937	(1980; R 1991) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C 939	(1994; Rev. A) Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM C 942	(1986; R 1991) Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

1.2.1 SD-02 Shop Drawings

a. Pile reinforcement

1.2.2. SD-04 Samples

a. Pier Sled

1.2.3 SD-06 Test Reports

a. Grout flow cone test

b. Grout compression test

1.2.4 SD-07 Certificates

a. Augering equipment

b. Grout injection equipment

Submit manufacturer's specifications for augering equipment and grout injection equipment.

1.2.5 SD-08 Statements

Submit evidence of experience of the piling contractor and job supervisor as required under paragraph entitled "Qualifications."

1.2.6 SD-11 Closeout Submittals

a. Pile drilling records

Upon completion, submit the pile records specified in paragraph entitled "Records."

1.3 QUALIFICATIONS

1.3.1 Experience

All piles shall be installed by an experienced piling contractor who is able to submit evidence of having a minimum of five (5) years experience in the successful installation of auger cast grout piles, including a job supervisor with a minimum of three (3) years of similar experience.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Grout

Grout shall consist of a mixture of portland cement, a pozzolanic material, fluidifier, sand, and water, proportioned and mixed to meet specified consistency and having a minimum compressive strength of 3000 psi at 28 days. Consistency shall be not less than 11 seconds when tested in accordance with the paragraph entitled "Flow Cone Test." Do not use other admixtures except as approved.

2.1.1.1 Portland Cement

ASTM C 150, Type II.

2.1.1.2 Pozzolanic Material

ASTM C 618, Class F.

2.1.1.3 Grout Fluidifier

ASTM C 937, except that expansion shall not exceed 5 percent.

2.1.1.4 Water

Water shall be fresh, clean, and free from sewage, oil, acid, alkali, salts, or organic matter.

2.1.1.5 Fine Aggregate

ASTM C 33, except as modified herein. The sand shall consist of hard, dense, durable, uncoated rock particles free from any substance which may be deleteriously reactive with the alkalies in the cement. If washed, use a washing method which will not remove desirable fines and which subsequently will permit the sand to drain until the residual-free moisture is uniform and stable. The sand shall be well graded, with the fineness modulus between 1.30 and 3.40. Fineness modulus shall be defined according to ASTM C 125 for U.S. Standard Sieve Nos. 1.18 mm, 600 micrometers, and 150 micrometers 16, 30, 50, and 100.

2.1.2 Reinforcement

2.1.2.1 Materials, assembly, and the placement of reinforcement shall conform to the requirements of Section 03300, "Cast-in-Place Concrete."

2.1.2.2 Provide pier sleds manufactured from concrete having a compressive strength of 8500 psi with integral plain finish tie wire, nominal size 8 inch by 3 inch by 1 1/4 inch. Provide a minimum of 2 rows of three sleds per rebar cage spaced uniformly to properly align cage in shaft. Acceptable manufacturer: Pieresearch, Arlington, Texas, Phone: (800) 342-2409.

2.1.3 Casings

Shall be approved steel, cylinder casings of sufficient strength and rigidity to withstand all installation stresses, to prevent distortion caused by placing adjacent piles and collapse due to soil or hydrostatic pressure.

2.2 EQUIPMENT

2.2.1 Augering Equipment

The auger hoisting equipment shall be capable of withdrawing the auger smoothly and at a constant rate. The minimum inside diameter of the hollow shaft of the augerflight shall be 1 1/4 inches.

2.2.2 Grout Injection Equipment

Grout injection equipment shall have a grout pressure gauge in clear view of the equipment operator. Grout pump shall be a positive displacement pump of an approved design. The pump discharge capacity shall be calibrated in strokes per cubic meter cubic foot or revolutions per cubic meter cubic foot. Remove oil or other rust inhibitors from mixing drums and pressure grout pumps prior to mixing and pumping.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

Install piles after rough grading at pile locations have been completed. The ground surface at each pile location at the time of augering and grouting shall be at least 12 inches higher than the required pile cutoff elevation, unless a steel casing will be used. Do not proceed with the installation of contract piles within any area of substantially different subsoil conditions until a satisfactory load test has been performed in that area.

3.1.1 Drilling

Drill each pile hole to the required tip elevation. Advance the auger at a continuous rate which prevents removal of excess soil. Stop rotation of auger after reaching the required pile tip elevation.

3.1.2 Grouting and Auger Removal

At the start of pumping grout, raise the auger from 6 to 12 inches and after grout pressure builds up, indicating discharge of grout, redrill auger to the required tip elevation, and fill pile hole with grout without interruption. Coordinate rate of grout injection and rate of auger removal from the soil in such a manner as to maintain a positive pressure on the grout pressure gauge. The gauge indicates the existence of a removing pressure on the bottom of the augerflight. If the auger jumps upward during withdrawal, or if the grouting process is interrupted, or if there is decreased grouting pressure, reinsert it to the original tip elevation and decrease the rate of withdrawal to prevent further jumping. The auger may rotate very slowly during withdrawal. However, counterclockwise rotation is not permitted.

3.1.3 Protection of Piles

The sequence of pile installation shall be such that adjacent piles show no evidence of disturbance, such as, a drop in the grout surface. The load applied to the soil by the drilling equipment shall be far enough away from the pile being drilled to avoid compressing or shearing the soil, which may in turn displace or squeeze off the grout column. Place no piles within 5 feet of adjacent augered piles until the grout in the augered piles has set for 24 hours. Place piles which are to be located immediately adjacent to test piles after placing test pile and after load testing.

3.1.4 Pile Butts

Unless a permanent steel casing is provided as specified in paragraph entitled "Casings," place a steel sleeve at top of pile to form the pile butt. For pile cutoff above ground surface, the steel sleeve shall extend from the pile cutoff elevation to a point not less than one foot below the ground surface. For pile cutoff at or below ground surface, the steel sleeve shall extend from the ground surface to a point not less than one foot below the pile cutoff elevation. Pump excess grout to displace as much potential laitance as possible. Remove pile butt to required cutoff elevation or to sound grout, whichever is lower.

3.1.5 Tolerances

Locate piles where indicated. The maximum permissible variation of the center of each pile from the required location is 3 inches at the ground surface. No pile shall be out of required axial alignment by more than 2 percent. Periodically check the required axial alignment of each pile during the drilling operation and after reaching required tip elevation with not less than 5 feet of the augerflight extending above ground surface. Abandon piles which are damaged, mislocated, or out of alignment beyond the maximum tolerance and provide additional piles where directed.

3.1.6 Cutoff

Removal of pile butts above the indicated cutoff elevation may be accomplished by dipping the grout from the pile, while grout is fluid, but not less than one hour after installation. At the option of the Contractor, and as approved prior to pile installation, grout may be allowed to harden at its initial top elevation and then carefully trimmed off to the indicated cutoff elevation with hand operated chipping guns.

3.1.7 Casings

Steel cylinder casings may be used as a soil retention liner. Casings shall be left in place and filled with grout. Install casing to the required depth by either rotation by an auger drive unit, using weights, or jetting. After the casing is in place, remove water, sediment, and debris from the casing, and cast pile in casing as specified in paragraph entitled "Installation Requirements."

3.1.8 Disposal of Excavated Material

Do not leave any piles partially completed overnight. Completely grout and protect piles at the termination of each day's operation. Dispose of excavated material, resulting from augering,off Government property.

3.2 FIELD QUALITY CONTROL

Continuous observation of the construction of pier foundations shall be conducted by a representative of the geotechnical engineer (RGE). The RGE shall verify the proper diameter of the shaft, depth, cleaning and also confirm the nature of materials encountered in the pier excavations. The geotechnical engineer is Agra Earth and Environmental of El Paso, Texas; telephone (915) 585-2472.

3.3 FIELD TESTS

3.3.1 Flow Cone Test

Perform flow cone test in accordance with ASTM C 939, except the flow cone shall be modified by removal of the 1/2 inch orifice allowing grout to pass through the 3/4 inch hole in bottom of cone. Conduct tests at the beginning of grout injection and at subsequent intervals to ensure specification requirements are met.

3.3.2 Grout Compression Test Specimens

Conduct grout tests in accordance with ASTM C 942 in an approved laboratory. Prepare test specimens by pouring grout into 2 inch cube molds. Cast not less than nine cubes during each 8 hour shift. Test three cubes at 7 days; three at 28 days; and three at 90 days.

3.4 RECORDS

Keep complete and accurate records of all auger-placed grout piles. Indicate the pile location, diameter, length, elevation of tip and top of pile, and quantity of grout material actually pumped in each pile hole. Determine grout quantity by recording grout pump displacement or by other approved means. Record and report immediately any unusual conditions encountered during pile installation.

END OF SECTION